

APPENDIX

Highway Vehicle Emissions Inventories and Forecasts for the Philadelphia Ozone Nonattainment Area

An Explanation of Methodology

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June 2001

HIGHWAY VEHICLE EMISSION METHODOLOGY

Additions with this SIP revision. The Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements (Tier 2 standards) for passenger cars, light trucks, and larger passenger vehicles will phase in more stringent emission standards starting with the 2004 model year. It affects a broader set of vehicles than the NLEV program. The program will, for the first time, apply the same set of federal standards to all passenger cars, light trucks, and medium-duty passenger vehicles. Light trucks include "light light-duty trucks" (or LLDTs), rated at less than 6000 pounds gross vehicle weight and "heavy light-duty trucks" (or HLDTs), rated at more than 6000 pounds gross vehicle weight). "Medium-duty passenger vehicles" (or MDPVs) form a new class of vehicles introduced by this rule that includes SUVs and passenger vans rated at between 8,500 and 10,000 GVWR. The program thus ensures that essentially all vehicles designed for passenger use in the future will be clean vehicles. Lower sulfur fuel to be available in 2004 ensures the effectiveness of low emission control technologies.

The final rule on Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements ("Tier 2 standards") for passenger cars, light trucks, and larger passenger vehicles was published on February 10, 2000 (65 FR 6698).

Tier 2 benefits for the Philadelphia area were calculated using EPA's MOBILE5 Information Sheet #8 which can be found on EPA's website at <http://www.epa.gov/otaq/m5.htm>.

Other than the addition of the Tier 2 control strategy, planning assumptions and modeling tools remain consistent with the revised highway budget found adequate by EPA (see http://www.epa.gov/otaq/transp/conform/phil_ltr.pdf).

For the reader's convenience, methodologies from that budget are summarized here. A description of Pennsylvania's highway vehicle emission inventory preparation methodology is also included.

Modeling Methodology and Input Parameters

Two additional control strategies were added in August 1999 to the planning assumptions for the Philadelphia area originally submitted with the Rate Of Progress plans: the new 2004 NOx standard for heavy-duty diesel engines (HDE) and the national low emission vehicle (NLEV) standard for light-duty gasoline-fueled vehicles. The methodology to calculate the NOx benefit of reformulated gasoline (RFG) has been revised slightly based on US EPA guidance released in September 1998.

Heavy-Duty Engines. A new HDE NOx standard was promulgated in October 1997 that combined emission standards of NOx and non-methane hydrocarbons (NMHC) from model year 2004 and later heavy-duty diesel engines used in trucks and buses. Manufacturers of such engines have the choice of certifying their new engines to either a 2.4 g/bhp-hr NMHC plus NOx standard, or to a 2.5 g/bhp-hr NMHC plus NOx standard with a limit of 0.5 g/bhp-hr on NMHC.

In the release of the modeling guidance for the 2004 HDE NOx standard, EPA also updated basic emission rates for model years 1990 and newer HDE. These rates provide a more accurate assessment of HDDV emissions and are included in the MOBILE5b version of the model. However, using version MOBILE5a_H, the emission rates for HDE model years 1990 to 2003 must be added to the base year emission factors using the guidance outlined by EPA. EPA issued guidance on January 30, 1998 on how to incorporate these standards in highway vehicle emission inventories using Mobile 5a. In EPA's analysis of the emission impacts of the new standard and the technologies which are likely to be employed to meet that standard, EPA has deemed it reasonable to model the impact of the combined standard as equivalent to that of a distinct 2.0 g/bhp-hr NOx standard and a 0.5 g/bhp-hr NMHC standard. The guidance has been followed in preparation of this SIP revision.

National Low Emission Vehicle Program. The NLEV program is a voluntary program agreed upon by Pennsylvania, the northeastern states and the auto manufacturers. New cars and light duty trucks up to 6,000 pounds gross vehicle weight will meet tailpipe standards that are more stringent than EPA can mandate prior to model year 2004. These standards will be federally enforced. Pennsylvania submitted a separate SIP revision upon adoption NLEV program regulations (Pennsylvania Code Title 25, Chapter 126). New vehicles meeting the NLEV standard were available in Pennsylvania (and several other northeastern states) with the 1999 model year and available nationally with the 2001 model year. An accurate methodology to quantify NLEV reductions was not available when the Philadelphia SIP was originally submitted in April 1998, but issued MOBILE Information Sheet #6 in July 1998, which has been followed in subsequent Philadelphia area SIPs.

Phase II Reformulated Gasoline. The MOBILE5aH model version does not provide NOx credit for Phase II RFG starting in the year 2000. To calculate the NOx benefit for RFG, MOBILE5b results are used to adjust the emissions results of the MOBILE5aH inventory. Based on EPA guidance, the difference in NOx emissions is divided by the MOBILE5b results without RFG to establish the fractional NOx RFG benefit. The fractional NOx benefit is multiplied by the NOx emissions based on MOBILE5aH to determine the NOx emission benefit from RFG. EPA guidance was provided in September 1998.

A sample calculation is provided below:

Bucks County 2005

MOBILE5aH Emissions Results =	26.02 tpd
MOBILE5b run without RFG =	27.95 tpd
MOBILE5b run with RFG =	26.30 tpd
Difference (5b w/ RFG – w/o RFG) =	-1.65 tpd
Fractional NOx Benefit (1.65 / 27.95) =	.059
RFG NOx Benefit (MOBILE5aH x .059) =	-1.53 tpd

PPAQ (Post-Processor for Air Quality). The PPAQ software system has gone through several updates to refine the software and increase its capability and flexibility. The current version is PPAQ3.28. Changes that affect the calculated emissions include the following:

- The diurnal emission calculation procedure now properly allocates diurnal emissions to time periods. This results in small changes in overall diurnal emission quantities.

The other changes to the PPAQ software system do not result in speed or emission calculation changes and instead simply increased the capability and flexibility of the software system.

Technical notes for this SIP revision

US EPA's MOBILE Model. The modeling was performed using EPA's approved MOBILE model, version MOBILE5a_H. The 5a_H version is an enhanced version of MOBILE5a that provides additional emissions credits for hybrid I/M programs and technician training and certification (TTC). The TTC credits are applied to Philadelphia and Pittsburgh areas that have implemented enhanced I/M programs. Pennsylvania requires all inspectors to be certified to perform an emissions inspection.

I/M Credit Data Files. EPA periodically updates their I/M credit files as new cutpoints are established. The new files can be easily downloaded from the EPA OMS or TNN websites. EPA's latest I/M credit data file for Tech IV+ vehicles (1981+ model years) is the IMDATA4.D. This file contains cutpoints for both final and start-up, and one and two mode ASM I/M programs. The single mode ASM5015 final cutpoints were used to represent Philadelphia's PA97 with ASM I/M program. The I/M credit file for Tech I and II vehicles (pre-1981 model years) is TECH12.D

Philadelphia 5-County Area – PA97 with ASM I/M Program. The PA97 with ASM program includes an ASM testing procedure (1981 MY and newer), idle test (1975 – 1980 MY), anti-tampering (1975 and newer MY), full pressure and purge (1981 and newer MY), and the gas cap pressure check (1975 to 1980 MY). All five counties (Bucks, Chester, Delaware, Montgomery and Philadelphia) are included in the program.

Modeling this area requires two scenarios, since the gas cap pressure check cannot be modeled directly with MOBILE. The first scenario is modeled with two I/M programs (one for the idle test for pre-81 model years and the second with ASM for model years 1981 and newer), anti-tampering (1975 and newer), EPA pressure and purge (1981 and newer). In the second scenario, the EPA pressure test is modeled to reflect 1975 and newer model years. This accounts for the gas cap pressure check for 1975 and 1980 vehicles. The resultant emissions are determined by crediting 40% of the pressure check credit using the following equation.

Example: Calculating the Gas Cap Pressure Check

$$\text{tpd w/ gas cap credit} = \text{tpd w/o gas cap} - [(\text{tpd w/o gas cap} - \text{tpd w/ gas cap}) \times 40\%]$$

$$14.41 \text{ tpd} = 14.65 - (14.65 - 14.05) \times 40\%$$

tpd = Tons per Day

Vehicle Age Distributions. Vehicle age distributions are input to MOBILE for each county based on registered vehicles that reflect July 1 summer conditions. These distributions reflect the percentage of vehicles in the fleet up to 25 years old and are listed by the eight EPA vehicle types. The updated vehicle age distributions have been acquired for this inventory submission from PennDOT Bureau of Motor Vehicles Registration Database. The modeling utilizes vehicle age distributions from July 1993.

Temperatures. The minimum, maximum and ambient temperatures were provided by the nearest weather station for each of the air quality districts for an average July summer day. These temperatures are the same as those that were used for the 1990 inventories.